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A CASE STUDY

Arboviral disease – Challenges and success in India

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Neglected tropical diseases focus its scope on the "neglected" communicable diseases of developing countries that do not receive sufficient priority in public health programmes and research agenda despite of having an equal share of the global burden of disease, both in terms of chronic disability and mortality. Tropical arboviral infections occur in poor urban and rural environments and disproportionately affect low-income populations. Other neglected viral infections, such as dengue and chikungunya, yellow fever, Japanese encephalitis and Rift Valley fever afflict the poor more frequently and more severely that can cause significant physical and mental impairment for > 30 months after infection or result in early death. Arboviral disease outcomes can contribute to poverty, perpetuating a vicious cycle of disease, poverty and health care injustice. Arbovirus infections typically occur in epidemics. Due to seasonal and weather-related changes in arthropod-borne transmission of arboviruses and periodic fluctuations in the number of susceptible humans within an area, there may be significant variation in the local, regional and global number of cases from year to year. Access to health care is another important issue for the neglected viral diseases. Previously successful strategies to control ABVDs emphasized vector control but source reduction and vector control strategies using pesticides have not been sustainable. Limitations in health systems in endemic areas undoubtedly lead to underestimation of arbovirus incidence and related complications. Effective prevention strategies can reverse this trend. Research on vaccines, environmentally safe insecticides, alternative approaches to vector control and training programs for health-care workers are needed. Perceptions about the actual frequency of arboviral disease are changing. As better diagnostics are introduced in at-risk areas, more accurate case finding allows for better definition of the risk of symptomatic disease and the long-term sequelae of infection.

Key words : Arboviral disease

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INTRODUCTION

The list of neglected tropical diseases is mainly comprised of helminths, protozoa and many tropical bacterial species that currently do not receive sufficient priority in international public health programmes and research agendas. The developed countries' nearly exclusive interest in HIV, TB and malaria frames the NTD problem and programs focused only on the "big three", in many respects, define the neglect of other tropical diseases. In this article, my premise is that the "neglected tropical viruses", in particular the arthropod-borne are a disease group that deserves to be considered among the NTDs. Recently, the World Health Organization (2012) added dengue virus as the first arbovirus to its list of NTDs. Because of their link to poverty in the developing world, I believe there are other arboviruses that should also follow suit. Globally, arthropod-borne virus infections are increasingly common causes of severe febrile disease that can progress to long-term physical or cognitive impairment or result in early death.

Arboviral diseases :

Arboviral diseases remain major threats to human health and well-being and as an epidemiologic group, inflict an unacceptable health and economic burden on humans and animals, including livestock. Arbovirus is a term used to refer to a group of viruses that are transmitted by arthropod vectors. The word arbovirus is an acronym (ARthropod-BOrne viruses). Some arboviruses are able to cause emergent disease (Gubler, 2002). These are transmitted by arthropods (e.g., mosquitoes, sandflies, ticks, or midges). More than 130 arboviruses are known to cause human disease.Arboviral diseases include West Nile virus disease, dengue, Japanese encephalitis, Chikungunya virus disease, yellow fever and other less common infections. In addition, there are other arthropod-borne viruses that cause hemorrhagic fevers and other illnesses that are important as diseases with international importance (e.g., Rift Valley fever); for reporting purposes they have been included under the condition "Rare Diseases of Public Health Significance" (LaBeaud *et al.*, 2011 and Morens *et al.*, 2004).

Who gets arboviral infections?

Anyone can get an arboviral infection. Susceptibility to the disease is highest in infancy and old age. Children appear to be most susceptible to La Crosse encephalitis (Rao, 2003).

Common symptoms of arboviral infections :

Most infections do not result in any symptoms or only mild symptoms of a slight fever and/or headache. Many arboviruses (such as African swine fever virus) do not normally infect humans or if so, cause only mild and transient infections characterized by fever, headache and rash. Severe infections are marked by a rapid onset of headache, high fever, disorientation, coma, tremors, convulsion and infrequently paralysis or death.

How soon after the bite from an infected mosquito do symptoms occur?

Symptoms usually occur 5 to 15 days after being bitten by an infected mosquito.

Does past infection with an arbovirus make a person immune?

Yes, infection with an arbovirus can provide immunity to that specific virus and possibly to other related viruses (Weaver and Reisen, 2010).

Description of illness :

Dengue fever :

Dengue fever (DF) is an acute febrile illness transmitted by various species of Aedes mosquitoes and is a major global public health problem. It is defined by the presence of fever and two or more of the following, retro-orbital or ocular pain, headache, rash, myalgia, arthralgia, leukopenia, or hemorrhagic manifestations (e.g., capillary fragility; gum bleeding; blood in vomitus, urine, or stool; or vaginal bleeding) but not meeting the case definition of dengue hemorrhagic fever. Anorexia, nausea, abdominal pain, and persistent vomiting may also occur but are not case-defining criteria for DF. Dengue fever virus has

Table 1: Geographic distribution and clinical characteristics of selected arboviral infections*

Disease (Etiologic agent)	Arthropod	Geographic distribution	Incubation period	Clinical syndrome
California serogroup viral encephalitis (La Crosse, Jamestown Canyon, Keystone, Snowshoe hare, Trvittatus, and California encephalitis viruses)	Mosquito	Widespread in the United States and Canada; most prevalent in upper Midwest; also South America, Europe, Asia	5–15 days	Encephalitis
Chikungunya fever (Chikungunya virus)	Mosquito	Africa; Asia	3–11 days	Fever, arthralgia, rash (hemorrhage rare)
Colorado tick fever (Colorado tick fever virus)	Tick	Western United States and Canada	1–14 days	Febrile illness rarely accompanied by encephalitis or myocarditis
Dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS) (dengue viruses)	Mosquito	Tropical areas worldwide: Caribbean, Central and South America, Asia, Australia, Oceania, Africa; recently reported from Florida	Commonly 4–7 days (range: 3-14 days)	Febrile illness; hemorrhagic fever and shock (particularly with second infection)
Eastern equine encephalitis (EEE virus)	Mosquito	Eastern seaboard and Gulf states of the United States; Canada; South and Central America	3–10 days	Encephalitis
Japanese encephalitis (Japanese encephalitis virus)	Mosquito	Asia; Pacific Islands; Northern Australia	5–15 days	Encephalitis, fever

an incubation period of 3 to 15 days.

Dengue hemorrhagic fever (DHF) is characterized by all of the following :

–Fever lasting from 2-7 days

–Evidence of hemorrhagic manifestation or capillary fragility (*i.e.*, a positive tourniquet test)

–Thrombocytopenia (≤100,000 cells per mm3)

–Evidence of plasma leakage shown by hemoconcentration (an increase in hematocrit ≤ 20 per cent above average for age or a decrease in hematocrit ≤ 20 per cent of baseline following fluid replacement therapy), OR pleural effusion, ascites or hypoproteinemia.

Dengue shock syndrome (DSS) has all of criteria for DHF plus circulatory failure as evidenced by:

–Rapid and weak pulse and narrow pulse pressure (<20 mmHg),

–Age-specific hypotension and cold, clammy skin and restlessness.

Prevention :

–There is no vaccine for dengue fever or malaria, but preventative drugs are available to reduce the risk of dengue.

– Preventing mosquito bites will prevent the common arboviral infections.

–Personal protective measures such as limiting the time spent outdoors at dawn and dusk or other times mosquitoes are active, wearing long sleeve shirts and pants when outdoors, using insect repellents that contain DEET when outdoors.

–Do not over use repellents.

–Take special care when using repellent on children.

–Screening your home to prevent mosquito entry can also serve to reduce to prevent mosquito bites.

–Reducing mosquito populations will also reduce mosquito bites.

–Eliminate standing water and sources of standing water (like, old tires, metal cans, ceramic pots, clogged rain gutters, wading pools, pool covers, and birdbaths) where mosquitoes breed.

–When traveling, using mosquito bed nets when exposure to mosquitoes may occur at night. Persons traveling to arboviral endemic areas should consult with a travel clinic health care provider regarding additional measures which should be taken in specific areas.

–Insecticides can be applied in rural and urban areas, inside houses and other buildings or in outdoor environments. They are often quite effective for controlling arthropod populations.

Challenges :

Factors involved in vector-borne disease emergence

–No effective mosquito control efforts are underway in most countries with dengue.

–Vaccines, available for only a few diseases (yellow fever, Japanese encephalitis, tick-borne encephalitis, tularemia, plague), are not widely used.

–Vaccine prospects for major vector-borne diseases are not good.

–Public health systems to detect and control epidemics are deteriorating around the world.

–Rapid growth of cities in tropical countries has led to overcrowding, urban decay and substandard sanitation, allowing more mosquitoes to live closer to more people.

–The increase in non-biodegradable plastic packaging and discarded tires is creating new breeding sites for mosquitoes.

–Increased jet air travel is helping people infected with dengue viruses to move easily from city to city.

Poverty as a main cause :

Poverty is an important determinant of arboviral infections, and even within wealthy industrialized nations, base of arboviral transmission arise in pockets of poverty. Tropical arboviral infections occur in poor urban and rural environments and disproportionately affect low-income populations. Arboviral disease outcomes can contribute to poverty, perpetuating a vicious cycle of disease, poverty, and health care injustice. Like other NTDs, dengue can lead to debilitating chronic sequelae that impact individual work productivity and family income. Some of them can lead to permanent visual loss or impairment, which can have a great impact on long-term productivity and quality of life. Importantly, viral NTD outbreaks generally lead to loss of life, family hardship, and distress. Japanese encephalitis is an extreme example, where case fatality rates can be as high as 30 per cent, with one-third of survivors suffering severe neurological sequelae. Poverty is not sufficient, by itself, to promote arboviral outbreaks; however, a community's inability to provide adequate vector control can perpetuate the spread of these diseases. Too often, the environmental conditions around urban slums result in perfect larval development sites that will easily support endemic mosquito cycling of disease. Although many viral infections are acute in nature and often resolve spontaneously, poor patients come to medical care late in the course of disease, as is often seen with dengue infections. Today, no effective drug or vaccine for dengue is commercially available. Previously successful strategies to control ABVDs emphasized vector control, but source reduction and vector control strategies using pesticides have not been sustainable.

The future :

- Reversing the trend of emergent/resurgent vector-borne diseases is a major challenge for future.
- Environmentally safe insecticides and research on alternative approaches (such as biological control) are needed.
- Integrated prevention strategies must be developed and implemented in endemic/enzootic-disease areas.
- In addition to economic support for research, human resources are needed to develop and implement sustainable prevention programmes.
- Policy changes must be made to support public health approaches to disease prevention.

WHO report :

Vector-borne diseases continue to plague world health.The World Health Organization estimates the following global annual impact that these diseases represent 17 per cent of the global disease burden due to all parasitic and infectious diseases recorded as disability-adjusted life years (Townson *et al.*, 2005). Globally, DHF has emerged as a major cause of hospitalization and death. The number of DHF cases reported from 1991 to 2011 is four times higher than that of the previous 30 years. In 2010, more than 2.5 billion persons live in areas of risk. Dengue is the second most important tropical disease (after malaria) with approximately 50 to 100 million cases of dengue fever and 500,000 cases of DHF each year.The World Health Organization, 2004 (WHO) estimates that, worldwide, as many as 100 million cases of the viral disease occur annually, resulting in up to half a million severe cases and more than 22,000 deaths, most occurring among children.

Success :

Prevention and control programs were soon based on controlling the arthropod vector. The discovery and effective use of residual insecticides in the 1940s, 1950s, and 1960s contributed greatly to these successes. However, the benefits of vector-borne disease control programmes were short-lived. A number of vector-borne diseases began to reemerge in the 1970s, a resurgence that has greatly intensified in the past 20 years. Although the reasons for the failure of these programmes are complex and not well understood, two factors played important roles: 1) the diversion of financial support and subsequent loss of public health infrastructure and 2) reliance on quick-fix solutions such as insecticides and drugs.

Conclusion :

We live in a rapidly changing world. We must be prepared for changes in the world in advance and prioritize health-related resources to prevent or reduce the impact of vector-borne diseases on human health. Limitations in health systems in endemic areas undoubtedly lead to underestimation of arbovirus incidence and related complications. Arbovirus control and prevention remains a high priority, both because of the current disease burden and the significant threat of the re-emergence of these viruses among much larger groups of susceptible populations. More research, more insight, and more discussions regarding these important NTDs and the populations that suffer from them will be necessary to fully define the impact of neglected tropical viruses in the regions where they persist. Dengue obviously affected all age groups.There are high incidence of severe dengue occurs in school age children. The reasons are unclear. Perhaps it may relate to the antibody or other factors. Bone marrow mass and compositions change with age. Thus, whether the high incidence in school age children correlated with the change of bone marrow compositions warrant more study. This may provide further fine tune in understanding the dengue pathogenesis and lead to a better vaccine development or control measure. Instead, researchers are working at developing vaccinations. Governments are also working on ways to eliminate the disease-carrying mosquito populations, but such progress is slow and difficult to enforce. Yet there is reason for optimism. Around the world, the rapid expansion of emerging-market economies is lifting millions out of poverty, allowing people to afford not only cars and televisions, but also secondary education and modern health care.

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